

## REMARKS

### **I. Status of the Claims**

Claims 1-23 were filed with the application and stand rejected, variously, under 35 U.S.C. §112, first paragraph, 35 U.S.C. §112, second paragraph, 35 U.S.C. §102 and 35 U.S.C. §103. The specific grounds for rejection, and applicants' response thereto, are set out in detail below.

### **II. Objections**

Claims 6 and 21-23 have been objected to for a various informalities. Appropriate amendments have been provided that address each objection.

### **III. Rejections Under 35 U.S.C. §112**

#### ***A. First Paragraph***

Claims 1, 5 and 6 are rejected under §112, first paragraph, as lacking enablement. The examiner argues that the claims should be limited to the use of alfalfa plants since all the examples of successful production of nanoparticles involve that species. Applicants traverse.

Attached to this response are two papers showing that, indeed, plants other than alfalfa can also tolerate precious metal environments, including *Convolvulus arvensis L.* and *Chilopsis linearis*, and that the latter has been studied for its ability to form gold nanoparticles. See Gardea-Torresdey, J. L.; Peralta-Videa, J. R.; Montes, M.; de la Rosa, G.; Corral-Diaz, B., "Bioaccumulation of cadmium, chromium and copper by *Convolvulus arvensis L.*: impact on plant growth and uptake of nutritional elements," *Bioresource Technology* (2004), 92(3), 229-235; Gardea-Torresdey, Jorge L.; Rodriguez, Elena; Parsons, Jason G.; Peralta-Videa, Jose R.;

Meitzner, George; Cruz-Jimenez, Gustavo, "Use of ICP and XAS to determine the enhancement of gold phytoextraction by *Chilopsis linearis* using thiocyanate as a complexing agent," *Analytical and Bioanalytical Chemistry* (2005), 382(2), 347-352.

As such, applicants submit that there is no reason to doubt, in general, the ability of plants to produce precious metal nanoparticles. Thus, it is submitted that the present claims are sufficiently enabled by the present specification. Reconsideration and withdrawal of the rejection is respectfully requested.

***B. Second Paragraph***

Claim 1 is rejected as allegedly indefinite in that the preamble does not reflect the final step of the claim. The preamble has been amended to address this concern.

Claims 8-14 are rejected on the grounds that "applicant's claim is so broad as to read on simply picking a leaf or stem ... [and] it is not clear if this is applicant's intent or if further isolation steps are required." Applicants traverse. Claim 1, from which all these claims depend, recites an isolation step. Thus, it is abundantly clear that the materials being obtained from the plant in claims 8-14 are to be used subject to the isolation step of claim 1. Thus, the rejection is traversed.

Claim 12 is rejected as "extraction" is not viewed as a chemical means of disrupting. Claim 12 has been amended to drop this term, which has now been introduced into claim 11, which recites physical means.

Claim 14 is rejected as unclear based on its dependency from claim 8, and whether the steps are to be applied to the isolated plant part. The claim has been amended to recite dependency from claim 10, which recites prior disruption.

Claim 16 is rejected for a variety of reasons. First, it is argued that it is unclear whether it recites an alternative to step (a) of claim 1, or an additional step. The answer is that it is the latter. According to claim 16, one will create a metal containing environment, and then select that environment for plant growth. This is not indefinite, and thus the rejection is traversed.

Another concern regarding claim 16 is said to be the undefined nature of creating the environment. However, there is nothing unclear about the claim's breadth, which simply specifies that the environment is created and leaves the specific mechanism by which that is accomplished to the specification. Further, as noted, dependent claims indeed provide different approaches to creating the environment. Thus, this aspect of the rejection also is traversed.

Finally, the examiner questions why one would create an environment, only to then purify the metals therefrom. This philosophical question does not appear pertinent to an inquiry under §112, second paragraph, so it is traversed.

Claim 17 is rejected on the grounds that the word "soil" is believed to have been meant to be "solid." The claim has been corrected.

Claim 21 is challenged on the grounds that (a) it is not clear where the "selecting" and "adjusting" takes place, and (b) the term "particle size" is confusing. Clarifying amendments have been provided to address each of these concerns.

#### **IV. Rejections Under 35 U.S.C. §102**

##### ***A. Gardea-Torresdey et al. (2002)***

Claims 1, 2, 5-9, 15-20 and 22 are rejected as anticipated by Gardea-Torresdey *et al.* (2002). Applicants submit that the reference is not "by another," as evidenced by the attached

declaration from the inventors. Therefore, it is respectfully submitted that the rejection is not proper and it should be withdrawn.

**B. U.S. Patent 5,927,005 (“the ‘005 patent”)**

Claims 1, 5, 8-10, 12 and 15 are rejected as anticipated by the ‘005 patent. The examiner argues that, since the present claims do not teach any particular steps beyond selecting a plant and growing it in the proper environment, the claims are anticipated. Applicants traverse.

First, the examiner overlooks step (c) of claim 1, which recites isolating the precious metal nanoparticle. There is no teaching in the ‘005 patent that nanoparticles were isolated. Second, the plant in question in the ‘005 patent is a creosote bush, *Larrea tridentata*. These plants are unique in that they produce a complex resin. According to the literature, creosote has several hundred of compounds, of which 125 have been structurally characterized. This resin has volatile compounds such as monoterpene hydrocarbons, sesquiterpenes, aromatics (like benzaldehyde) and others. Downum, K. R.; Dole, J.; Rodriguez, E., *Biochemical Systematics and Ecology* (1988), 16(6), 551-5. Sakakibara, Masayuki; DiFeo, Dan, Jr.; Nakatani, Nobuji; Timmermann, Barbara; Mabry, Tom J., *Phytochemistry* (Elsevier) (1976), 15(5), 727-31. In addition, creosote bush produces a large quantity of nordihydroguaiaretic acid, which is the principal phenolic constituent in the leaf resin. It is therefore quite unclear that the plants described in the ‘005 patent produced nanoparticles.

In light of the foregoing, applicants respectfully submit that there is no evidence that nanoparticles were obtained in the ‘005 patent, or that they even were formed. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

**C. U.S. Patent 5,785,735 (“the ‘735 patent”)**

Claims 1-3, 5, 8, 9 and 15-19 are rejected as anticipated by the ‘735 patent. Again, applicants traverse in that the examiner overlooks step (c) of claim 1, which recites isolating the precious metal nanoparticle. However, there is no teaching in the ‘735 patent that nanoparticles were isolated. Moreover, it has now been demonstrated by Reconsideration and withdrawal of the rejection is therefore respectfully requested.

**V. Rejections Under 35 U.S.C. §103**

**A. Gardea-Torresdey *et al.* (2002)**

Claims 10-14 are rejected as obvious over Gardea-Torresdey *et al.* (2002). Applicants submit that the reference is not “by another,” as evidenced by the attached declaration from the inventors. Therefore, it is respectfully submitted that the rejection is not proper and it should be withdrawn.

**B. U.S. Patent 5,927,005**

Claims 2-4 and 10-14 are rejected as obvious over the ‘005 patent. As discussed above, there is no teaching in the ‘005 patent of a step of obtaining nanoparticles, as recited in each of the claims of the instant application. As such, the reference alone cannot render obvious the present claims as it fails to teach each element of the claimed invention. Furthermore, given the unpredictability regarding the capacity of the creosote bush to produce nanoparticles, there is also no likelihood of success – yet another failed requirement for obviousness. So, for both of these reasons, applicants respectfully submit that no *prima facie* case of obviousness exists in

view of the '005 patent. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

**C. U.S. Patent 5,785,735**

Claims 10-14 are rejected as obvious over the '735 patent. As discussed above, there is no teaching in the '735 patent of a step of obtaining nanoparticles, as recited in each of the claims of the instant application. As such, the reference alone cannot render obvious the present claims as it fails to teach each element of the claimed invention. Thus, applicants respectfully submit that no *prima facie* case of obviousness exists in view of the '735 patent. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

**D. Gardea-Torresdey (1999a) and (1999b)**

Claims 1-20, 22 and 23 stand rejected as obvious over Gardea-Torresdey (1999a) and (1999b). The examiner argues that the prior teachings of metal remediation using alfalfa biomass render obvious the use of live, growing plants in the process of preparing nanoparticles. Applicants traverse.

It should be pointed out that the 1999(a) reference shows growth of alfalfa in solution, whereas the present claims required a solid plant growth medium. Thus, there would be no interference with the uptake of the metal by the medium. However, in solid medium like soil, metals can undergo reactions that can complex them to other agents, which may inhibit either uptake or the formation of nanoparticles.

Furthermore, there is not a link between dead plants and living plants when discussing the formation of nanoparticles. Living plants are active systems that can form the nanoparticles if

the plants grow in solid or liquid media containing the precious metals (gold or silver). It is now known that living plants produce chemical molecules called phytosiderophores which have the ability to solubilize metals that are later taken up and used to produce the nanoparticles inside the plant. On the other hand, dead biomass forms particles due to a passive process occurring when the dead biomass is in contact with a metal-containing liquid medium, and there was no reason to believe that this activity would have any relevance in an intact, living plant.

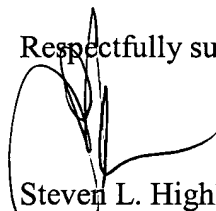
For all of these reasons, applicants submit that it clearly was *not* obvious that living plants could form nanoparticles from precious metals. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

## **VI. Conclusion**

In light of the foregoing, applicants respectfully submit that all claims are in condition for allowance, and an early notification to that effect is earnestly solicited. Should the examiner have any questions regarding this response, a telephone call the undersigned is invited.

Please date stamp and return the enclosed postcard evidencing receipt of these materials.

Respectfully submitted,



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